

HEWLETT  PACKARD

2100 series computers

DIAGNOSTIC CONFIGURATOR

HP Product No. 24296

June 1973

*Manual of Diagnostics
02100-90157*

List of Effective Pages

Pages	Effective Date
Title	June 1973
Copyright.	June 1973
1 to 15.	June 1973
17 to 19	June 1973

Printing History

First Edition. June 1973

HP 2100 Series Diagnostic Configurator

This manual describes the characteristics and use of the 2100 Series Diagnostic Configurator. Diagnostic-user interface with the Configurator is described along with general software operating procedures of the 2100 Series Diagnostics. Common characteristics and conventions of 2100 Series computers are also described including diagnostic and Diagnostic Configurator loading procedures.

The Configurator is primarily designed to make one set of diagnostics compatible with the entire HP 2100 family of computers and peripherals. The PRODUCT APPLICABILITY chart, which appears at the back of this Configurator manual, identifies which computer and which device are usable with each diagnostic program in the series. The chart is updated periodically and represents the latest information as of the date you receive this manual.

When the user has completed the configuration process, he has a diagnostic program tailored to his hardware system. He should save this configured diagnostic by dumping it on paper tape via the configurator dump utility routine.

Compatibility for all these models is accomplished by providing general processing functions common to 2100 Series diagnostics and accepting and storing the system hardware configuration parameters.

Processing functions provided are:

- I/O drivers for two "fast" and two "slow" devices (~~see MOD's for definition of "fast" and "slow" devices required~~).
- Operator-communication message formatting and output
- Data type conversion
- Switch register checking
- Call-back millisecond timer
- Binary Dump
- Configurator self-relocation program

Stored by Configurator for diagnostic use are:

- Computer type, options, and timing
- Available memory

GENERAL ENVIRONMENT

Hardware Configuration

Diagnostic Configurator and diagnostic run in conjunction on 2100-series computers with any possible configuration of standard and optional features. A paper tape reading device is necessary for loading the Configurator itself.

I/O-communication service-programs are provided for the use of 2100-series diagnostics. The actual hardware configuration, from those listed below, depends on the installation.

List and Keyboard

Teleprinter 2752, 2754, 2762A

Keyboard-Display Terminal 2600A

Line Printer 2610A, 2614A, 2767A

Dump

Paper Tape Punch 2753A & B, 2895A

Line Printer 2610A, 2614A, 2767A

Read

Paper Tape Reader 2748A & B, 2758A

Software Required

The only program required that is separate from the Diagnostic Configurator and the executing diagnostic is the Binary Loader. See the appropriate *Front Panel Procedures* for the 2100-series computer being used for use of the Binary Loader. The Basic Binary Loader and Basic Binary Disc Loader are described in the HP manual *Basic Binary Loader - Basic Binary Disc Loader* (HP product Number 5951-1376).

Operating Procedures

Operating procedures for the Configurator cover four user functions. These are:

- Loading the Diagnostic Configurator
- Configuring the Configurator
- Loading the executing diagnostic
- Dumping memory to punched paper tape

LOADING

Use the Binary Loader to load the Diagnostic Configurator first. Perform system configuration (CONFIGURING below); then load the executing diagnostic using the Binary Loader.

CONFIGURING

System hardware configuration using the Configurator consists of inputting parameters via the switch register. The user is prompted by a series of Memory Data Register (MDR) coded halts. In general, six sets of parameters are input via the switch register:

- Computer Type and Options
- Four System I/O Devices
- Memory Size and Type

Extra configuration parameters may be required for the System I/O devices, if those to be configured with the diagnostic are not standard devices.

Figure 1 shows a flow charted summary of the diagnostic hardware configuration sequence.

Note: All numbers given in the configuration procedure are octal.

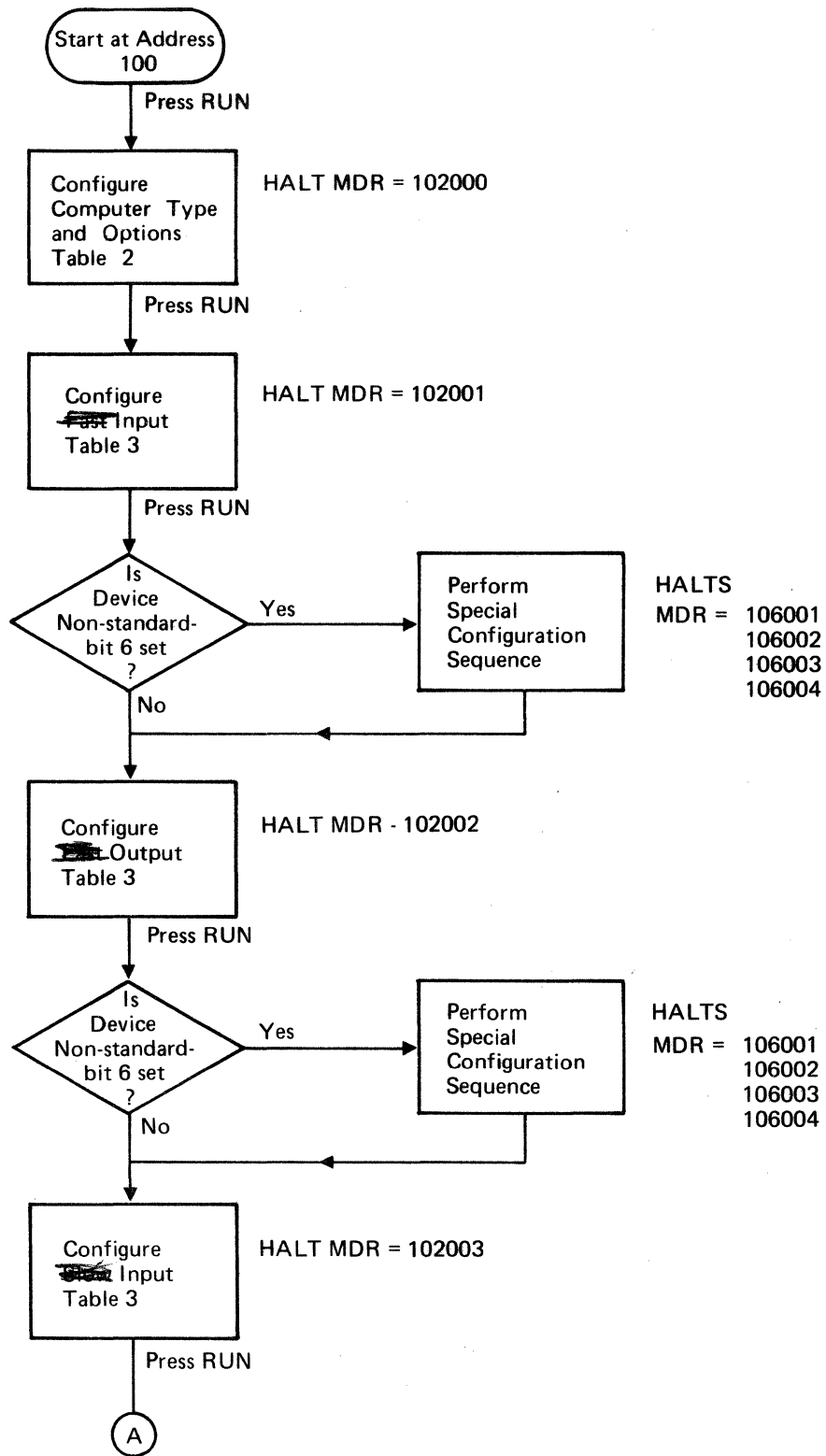


Figure 1. Configure System Diagnostic Hardware

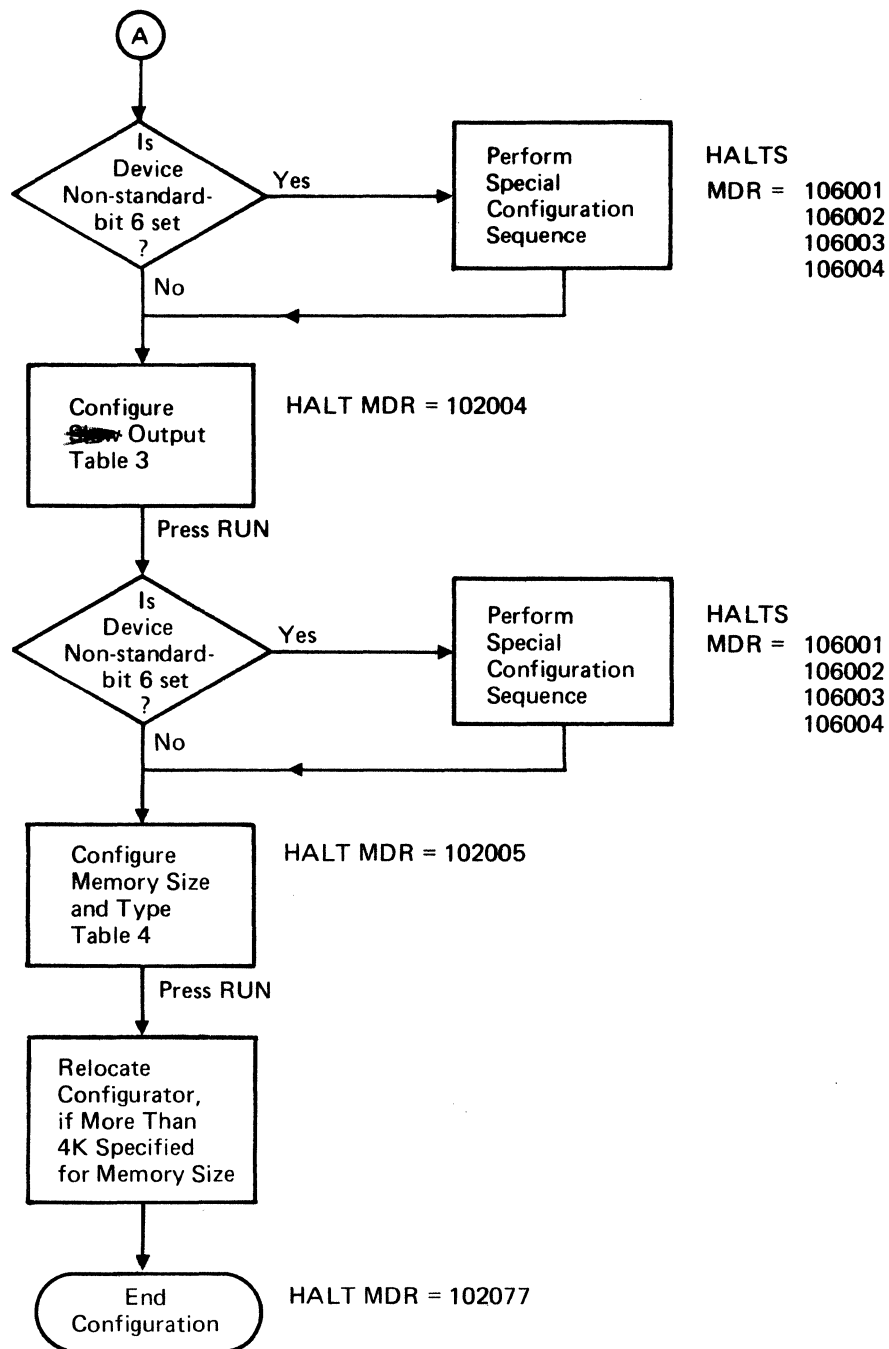


Figure 1. Configure System Diagnostic Hardware (continued)

Configuration Procedure

a. *Begin Configuration*

ACTION	EXPLANATORY INFORMATION
Enter 100 into P-register.	
Press PRESET. (EXTERNAL & INTERNAL, if applicable.)	
Press RUN.	Initiate configuration execution.

Result: HALT with MDR = 102000.

b. *Establish Computer Type and Options*

ACTION	EXPLANATORY INFORMATION
Enter COMPUTER TYPE AND OPTIONS into switch register according to format shown in Table 1.	The user determines COMPUTER TYPE from label on Front Panel of CPU. Hardware OPTIONS installed on the particular 2100 series computer must be determined from installation records or by installed boards, etc. Table 2 holds summary of optional, available and unavailable hardware options.
Press RUN.	

Result: HALT with MDR = 102001 indicates valid configuration.

HALT with MDR = 103000 indicates invalid computer type and/or options specified.

Recovery Procedure: Enter valid computer type and options into switch register and press RUN.

c. *Establish ~~Fast~~ Input Device*

ACTION	EXPLANATORY INFORMATION
Enter DEVICE TYPE AND SELECT CODE into switch register according to format in Table 3.	Table 3 holds switch register format of Device Type and Select Code Entry. If no fast input device is required, leave switch register zero. If device is Paper Tape Reader or Teleprinter Reader, then simply enter device select code and switch 11 or 15.
Press RUN.	If neither switch 11 or 15 is appropriate and another fast input device is required, then set switch register bit 6 and follow Special Configuration Procedure described in next section of manual.

Result: HALT with MDR = 102002 indicates valid ~~fast~~ input configuration.

HALT with MDR = 103001 indicates incomplete entry.

Recovery Procedure: Remake switch register entry and press RUN.

HALT with MDR = 103011 indicates invalid device type specified for ~~fast~~ input device (e.g. line printer).

Recovery Procedure: Remake switch register entry and press RUN.

d. *Establish ~~Fast~~ Output Device*

ACTION	EXPLANATORY INFORMATION
Enter DEVICE TYPE AND SELECT CODE into switch register according to format in Table 3.	If no fast output device is required, leave switch register zero. If one of the standard devices specified in Table 3 is to be used, then simply enter device select code and device type into switches from Table 3.
Press RUN.	If no device type switch is appropriate, then set bit 6 and follow Special Configuration Procedure in next section of manual.

Result: HALT with MDR = 102003 indicates valid ~~fast~~ output configuration.

HALT with MDR = 103002 indicates incomplete entry.

Recovery Procedure: Remake switch register entry and press RUN.

HALT with MDR = 103012 indicates invalid device type specified for ~~fast~~ output device.

Recovery Procedure: Remake switch register entry and press RUN.

e. *Establish ~~Slow~~ Input Device*

ACTION	EXPLANATORY INFORMATION
Enter DEVICE TYPE AND SELECT CODE into switch register according to format in Table 3.	If no slow input device is required, leave switch register zero. If one of the standard devices specified in Table 3 is to be used, then simply enter device select code and device type into switch register from Table 3. If no device type switch is appropriate, then set bit 6 and follow Special Configuration Procedure in next section of manual.
Press RUN.	

Result: HALT with MDR = 102004 indicates valid ~~slow~~ input configuration.

HALT with MDR = 103003 indicates incomplete entry.
Recovery Procedure: Remake switch register entry and press RUN.

HALT with MDR = 103013 indicates invalid device type specified for ~~slow~~ input.
Recovery Procedure: Remake switch register entry and press RUN.

f. *Establish ~~Slow~~ Output Device*

ACTION	EXPLANATORY INFORMATION
Enter DEVICE TYPE AND SELECT CODE into switch register according to format in Table 3.	If no slow output device is required, leave switch register zero. If one of the standard devices specified in Table 3 is to be used, then simply enter device select code and device type into switch register from Table 3. If no device type switch is appropriate, then set bit 6 and follow Special Configuration Procedure in next section of manual.
Press RUN.	

Result: HALT with MDR = 102005 indicates valid ~~slow~~ output configuration.

HALT with MDR = 103004 indicates incomplete entry.
Recovery Procedure: Remake switch register entry and press RUN.

HALT with MDR = 103014 indicates invalid device type specified for ~~slow~~ output.
Recovery Procedure: Remake switch register entry and press RUN.

g. *Establish Memory Size and Type*

ACTION	EXPLANATORY INFORMATION
Set switch register to MEMORY SIZE AND TYPE according to format in Table 4.	Bits 12 through 14 hold MS value according to Table 4 memory size codes. Bit 0 must be set to 1.
Press RUN.	
<i>Result:</i> If more than 4K of memory specified, Configurator is relocated automatically to upper end of memory.	
HALT with MDR = 102077.	
Configuration is complete and diagnostic may be loaded.	

Special Configuration Procedure

This procedure is followed if a non-standard I/O device was selected for a system I/O device during configuration. Bit 6 set in the switch register indicates that this Special Configuration Procedure is to be followed to establish non-standard I/O parameters in a Special Device Table.

Before configuring the non-standard device, the user must know four parameters for the device I/O. These may be obtained from the software driver manual or hardware interface manual for the device used.

Mode of Operation is 16 bits of data to be given the device prior to I/O operation to ready the device.

Device Response Time is the octal number of milliseconds delay required between the output of successive records; e.g., time required for Line Feed on line printer.

Device Status Bit parameter points to Ready Status Bit position in Status Word from the device and indicates whether set or not-set means device is ready.

Device Operation Command is the I/O function the device is to perform after a record of output; e.g. line feed.

a. *Initiate Special Device Configuration*

ACTION	EXPLANATORY INFORMATION
Set bit 6 of switch register during system I/O device configuration.	Instead of specifying a particular device, special device is selected.
Press RUN.	

Result: HALT with MDR = 106001.

b. *Establish Mode of Operation*

ACTION	EXPLANATORY INFORMATION
Set MODE OF OPERATION into switch register.	Exact bit configuration of word to be sent to device just prior to I/O initiation.
Press RUN.	

Result: HALT with MDR = 106002.

c. *Establish Device Response Time*

ACTION	EXPLANATORY INFORMATION
Set DEVICE RESPONSE TIME into switch register.	The exact number of milliseconds (octal integer) required between successive records.
Press RUN.	

Result: HALT with MDR = 106003.

d. *Establish Device Ready Status Bit*

ACTION	EXPLANATORY INFORMATION
Set octal bit number of the device Ready Status Bit in switch register bits 0 through 4.	Set switch register = 0, if no status check is made; switch register = 1, if bit 0 holds Ready Status bit, switch register = 2, if bit 1 holds Ready Status bit, etc. Thus if Ready Status Bit = i, set switch register to i + 1.
Set switch register bit 15, if Ready Status Bit <i>set</i> indicates <i>ready</i> ; otherwise leave clear.	Bit 15 of switch register indicates ready condition of Ready Status Bit. For example: if bit 7 is Ready Status Bit and Ready Status Bit set indicates device is ready, switch register holds 1 000 000 000 001 000.

Press RUN.

Result: HALT with MDR = 106004.

e. *Establish Device Operation Command*

ACTION	EXPLANATORY INFORMATION
Set switch register to Operation Command.	This is the exact bit configuration of the command to be executed after a record of data has been output.

Press RUN.

Result: Diagnostic system I/O configuration sequence returns to standard configuration procedure with a HALT MDR code of 10200*n*, where *n* depends on which I/O type is being configured.

Use of Configured Configurator

Now that configuration is complete, any diagnostic in the 2100 series diagnostics may be loaded with Binary Loader. The configuration makes them compatible with any configuration. In order to not have to repeat the configuration process, memory should be dumped following configuration. Thus any time a new diagnostic is to be used, the new diagnostic may be loaded after the already configured Configurator. Both may then be dumped for future use.

Table 1. Computer Type and Options

SWITCH	AVAILABLE IF SET
0	POWER FAIL AUTO RESTART
1	EXTENDED ARITHMETIC UNIT
2	DMA (one or two channel)
3	CENTRAL INTERRUPT REGISTER
4	MEMORY PARITY CHECK
5	MEMORY PROTECT
6	FLOATING POINT
7	DMA1 ONLY (only one DMA channel available)
8	RESERVED
9	RESERVED
10	RESERVED
11	RESERVED
12	COMPUTER TYPE CODE
13	
14	
15	

COMPUTER TYPE	CODE				Bits
	15	14	13	12	
2116A	0	0	0	1	
2116B	0	0	1	0	
2116C	0	0	1	1	
2115A	0	1	0	0	
2114A	0	1	0	1	
2114B	0	1	1	0	
2100A	0	1	1	1	
2100S	0	1	1	1	

Table 2. Computer Features

COMPUTER	OCTAL TYPE CODE	PF	EA	DM	CI	MY	MT	FP	D1
2116A	01	X	X	X	X*	X	X	0	0
2116B	02	X	X	X	1	X	X	0	0
2116C	03	X	X	X	1	X	X	0	0
2115A	04	X	X	X	X*	0	X	0	0
2114A	05	X	0	0	1	0	X	0	0
2114B	06	X	0	X	1	0	X	0	X
2100A	07	1	1	X	1	1	1	X	0
2100S	07	1	1	1	1	1	1	1	0

Legend

X = optional feature
 0 = feature not available
 1 = standard feature

PF = Power Fail Auto Restart
 EA = Extended Arithmetic Unit
 DM = Direct Memory Access (DMA)
 CI = Central Interrupt
 MY = Memory Parity
 MT = Memory Protect
 FP = Floating Point
 D1 = One Channel DMA Only

*Note: Early serial numbers of 2115A & 2116A computers did not have this as a standard feature.

Table 3. Device Type and Select Code

SWITCH	IF SET
0	} DEVICE I/O SELECT CODE (10_8 through 77_8)
1	
2	
3	
4	
5	
6	SPECIAL DEVICE TABLE*
7	2767A LINE PRINTER*
8	2610A-2614A LINE PRINTER*
9	RESERVED
10	2753A/B PAPER TAPE PUNCH (2895A/B TAPE PUNCH)
11	2748A/B PAPER TAPE READER (2758A REROLLER)
12	2762A PRINTER TERMINAL
13	2605A CONSOLE PRINTER
14	2600A KEYBOARD DISPLAY TERMINAL
15	TTY (2752 or 2754)

*If device is found not ready, a HALT 107056_8 will occur.

Table 4. Memory Size and Type

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
N	MS		N												1

N not used

MS describes memory size:

Memory Size	MS Value
4K	0
8K	1
12K	2
16K	3
20K	4
24K	5
28K	6
32K	7

Dumping to Paper Tape

The operator may dump memory contents onto paper tape anytime after the Configurator is loaded. Memory contents are dumped except for empty area. If the diagnostic has already been loaded, then it is dumped as well. Thus a diagnostic package may be produced by loading on already configured tape of the Configurator along with a compatible 2100 series diagnostic and then dumping them together via the Configurator dump option.

Resulting tape may be loaded with Binary Loader.

To dump memory onto paper tape:

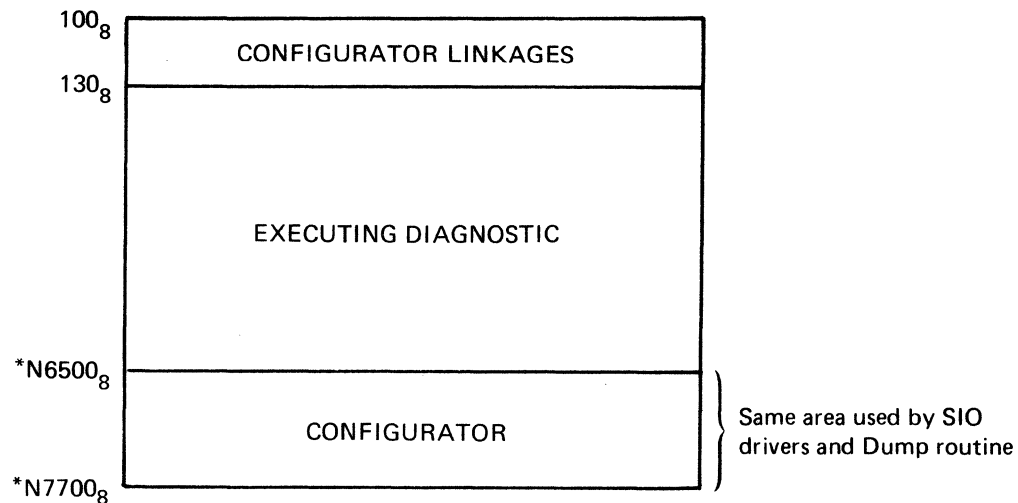
ACTION	EXPLANATORY INFORMATION
Load P-register with (MS)7677.	MS is the configured memory size as specified in Table 4. Thus if memory size was configured to be 4K, MS = 0 and P-register is loaded with 07677.
Load select code of paper tape punch into switch register.	Select code of punch goes in lower bits.
Press PRESET. (EXTERNAL AND INTERNAL, if applicable.)	
Press RUN.	
<i>Result:</i> Program will dump leader, memory contents, and trailer on specified punch.	
HALT with MDR = 102077.	

Program Structure

The Diagnostic Configurator provides capabilities in addition to those used by the diagnostic user. It provides a set of drivers and utility routines used by the executing diagnostic itself. Configuration and status information are kept for reference by the executing diagnostic.

MEMORY

The executing diagnostic must be loaded at 130_8 and may extend to the location that is 1300_8 words *before* the end of memory (6500_8 for 4K). Obviously, if the required diagnostic occupies memory higher than 6500_8 , additional memory is required. Figure 2 summarizes memory structure.



*N depends on amount of memory used.
Configurator requires 1200_8 words of a 4K memory module.

Figure 2. General Memory Structure

LINKAGE

Linkage between the Diagnostic Configurator and the executing diagnostic are stored in the Linkage Table. Contents of the Linkage Table are shown in Table 5.

Table 5. Linkage Table

OCTAL ADDRESS	CONTENTS
100	A jump to start of executing diagnostic
101	Address of fast data input driver
102	Address of slow data output driver
103	Address of fast data output driver
104	Address of slow data input driver
105	Address of first word of unused available memory
106	Address of last word of unused available memory
107	Reserved location
110	One millisecond time-out counter
111	Fast input device select code
112	Slow output device select code
113	Fast output device select code
114	Slow input device select code
115	Computer type and options parameter
116	Diagnostic device select code and options
117	Memory size
120	Internal Switch Register
121	Address of One millisecond timer routine
122	Address of Switch checking routine
123	Address of Integer to ASCII conversion routine
124	Address of Octal to ASCII conversion routine
125	Address of ASCII to Octal or Integer conversion routine
126	Diagnostic Serial Number
127	Address of Message formatter routine

DIAGNOSTIC UTILITIES

The Diagnostic Configurator provides a set of utility routines used by the executing diagnostic. These provide switch register checking, timing, data conversion and message output formatting.

Switch Register Checking interrogates switches specified by executing diagnostic and tells the diagnostic whether or not they are set.

One Millisecond Timer provides the executing diagnostic with the capability to set an “alarm clock,” which will call the diagnostic back in a specified number of milliseconds.

Data Conversion is made for the executing diagnostic between three types of data used: integer, octal, and ASCII.

Formatted Output of ASCII data strings is made for the executing diagnostic.

PRODUCT APPLICABILITY

The following diagnostic programs are used in conjunction with The HP 2100 Series Diagnostic Configurator, which serves to make the diagnostic programs compatible with indicated HP 2100 series computer models.

[illegible]

June 1, 1973